INSTRUCTION MANUAL

FOR MODEL

TTS 28

PORTABLE STATION

TEST SET

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NORTHEAST ELECTRONICS CORPORATION

P.O. BOX 649 - CONCORD, N. H. 03301

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TABLE OF CONTENTS

Section	Title	Page
1	DESCRIPTION	1-1
	1.1 Introduction	1-1
2	SPECIFICATIONS	2-1
	2.1 Introduction	2-1
3	OPERATING INSTRUCTIONS	3-1
	3.1 Introduction	3-1
	3.3 Preliminary Steps	3-1
	3.4 Dialing Through	3-1
	3.5 Level Measurement	3-2
	3.6 Line Current Measurement	3-2
	3.7 Ac Voltage Measurement	3-2
	3.8 Dc Voltage Measurement	3-2
	3.9 Dc Current Measurement	3-2
	3.10 Resistance Measurement	3-3
4	CIRCUIT DESCRIPTION	4-1
	4.1 Introduction	4-1
	4.3 Level Measuring Circuit	4-1
	4.5 Ac Measuring Circuit	4-1
	4.7 Multimeter Functions	4-1
	4.9 Through Connections	4-1
5	MAINTENANCE	5-1
	5.1 Introduction	5-1
	5.3 Battery Replacement	5-1
	5.5 Meter Mechanical Zero	5-1
	5.7 Level Calibration	5-1
6	ELECTRONIC PARTS LIST	6-1
	6.1 Introduction	6-1
7	SCHEMATIC DIAGRAMS	7-1
	7.1 Introduction	7-1

LIST OF ILLUSTRATIONS

Number	Title	Page
1-1	TTS 28 Portable Station Test Set	1-0
6-1	Printed Circuit Board, Component Location	6-3
7-1	TTS 28 Portable Station Test Set, Schematic Diagram	7-2

LIST OF TABLES

2-1	Specifications	2-1
6-1	List of Manufacturers	6-1
6-2	TTS 28 Overall Parts List	6-2
6-3	Switch Subassembly S2 Parts List	6-2
6-4	Component Board Parts List	6-3

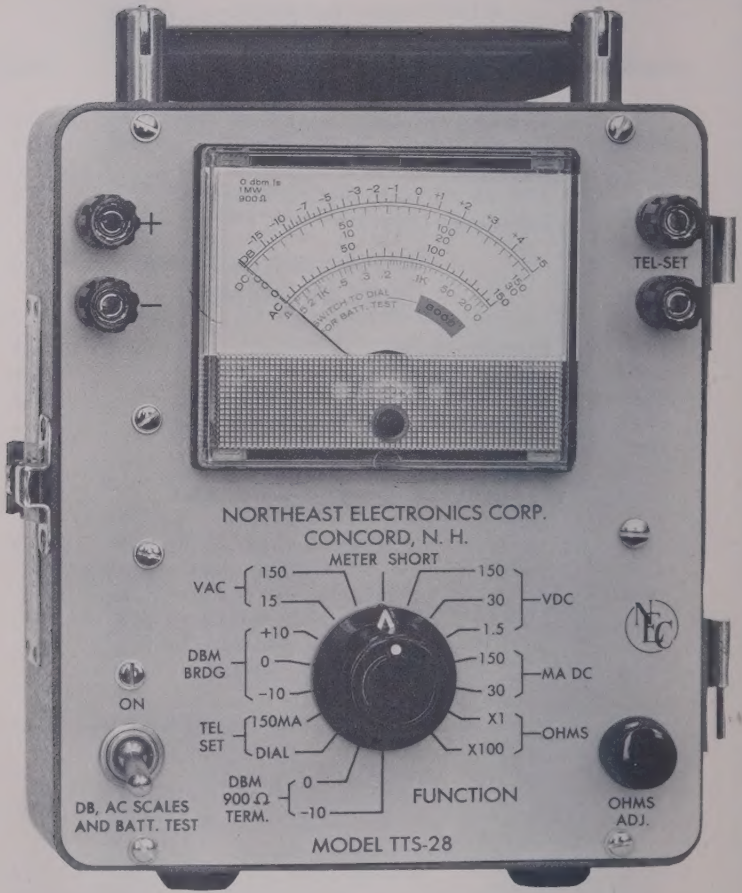

Figure 1-1. TTS 28 Portable Station Test Set

SECTION 1

DESCRIPTION

1.1 INTRODUCTION.

1.2 The Northeast Electronics Corporation Model TTS 28 Portable Station Test Set (figure 1-1) is a solid-state, battery-operated unit that is a combination level measuring set and multimeter. Level measurements can be made on a 900Ω terminated basis between -25 dBm and +5 dBm and on a bridged basis from -25 dBm to +15 dBm with a bridging impedance of 15,000Ω minimum. In addition to level measurements it is also possible to measure ac voltages up to 150 volts in two ranges, dc voltages up to 150 volts in three ranges, dc current up to 150 milliamperes in two ranges, and resistance up to 500,000Ω in two ranges.

1.3 The level measurements are accurate to within ±0.3 dB over the frequency range of 500 Hz to 20,000 Hz. The amplifier is useful to approximately 500 kHz but requires individual calibration above 20,000 Hz. To suppress 60 Hz interference, a high-pass filter is included in the amplifier. A holding resistor is provided in the terminated level measuring mode. A set of through terminals makes it possible to dial through the unit and measure the current in an externally connected telephone set. A meter movement shorting position is provided to prevent damage during transportation. A hinged metal cover with storage space for the 4-foot test leads provided is also included. When the cover is closed, the power switch is automatically returned to the off position to prevent drain on the batteries.

SECTION 2

SPECIFICATIONS

2.1 INTRODUCTION.

2.2 Table 2-1 lists the specifications for the Model TTS 28 Portable Station Test Set.

Table 2-1. Specifications

RANGES	
Level Measurements	
900 Ω terminated	-25 dBm to -5 dBm -15 dBm to +5 dBm
Bridging	-25 dBm to -5 dBm -15 dBm to +5 dBm -5 dBm to +15 dBm
Dc Voltage	0 to 1.5 volts 0 to 30 volts 0 to 150 volts
Dc Current	0 to 30 milliamperes 0 to 150 milliamperes
Ac Voltage	0 to 15 volts 0 to 150 volts
Resistance	0 to 5,000Ω 0 to 500,000Ω
INPUT IMPEDANCE	
Terminated	900Ω ±1% at 1000 Hz, 935Ωdc
Bridging	15,000Ω from 625 Hz to 3500 Hz
Ac Volts	20,000 Ω per volt nominal
Dc Volts	20,000 Ω per volt nominal

Table 2-1 Specifications (cont)

LEVEL ACCURACY	Referred to 0 dBm on -15 to +5 scale, 1000 Hz at +70° F
With Battery Voltage	±0.2 dB from 6 to 9 volts
With Attenuator	±0.1 dB
With Temperature	-0.3 dB to +0.1 dB from +40° F to +120° F
AC VOLTS ACCURACY	±3% of full scale at +70° F
DC VOLTS AND MA ACCURACY	±3% of full scale at +70° F
METER ACCURACY	1% of full scale
FREQUENCY RESPONSE LEVEL	Referred to response at 1000 Hz in level modes. ±0.3 dB from 500 Hz to 20,000 Hz. Down 6 dB minimum at 180 Hz. Down 25 dB minimum at 60 Hz Can be calibrated for frequencies up to approxiamtely 500 kHz.
Ac Voltage	±3% from 50 Hz to 20,000 Hz
BATTERIES	one 9-volt Burgess P6M or equivalent. Two 1½ volt size AA Burgess No. Z or equivalent
BATTERY LIFE	Approximately 200 hours with intermittent operation
TEST LEADS	Two 4-foot leads provided
SIZE	7"h x 6"w x 4" d
WEIGHT	4 pounds

SECTION 3

OPERATION

3.1 INTRODUCTION.

3.2 The following paragraphs provide instructions for each of the operating modes of the TTS 28.

NOTE

The TTS 28 was calibrated while the instrument was in a vertical orientation. To obtain the specified accuracy, the instrument must also be operated in the vertical orientation.

3.3 PRELIMINARY STEPS.

1. Unlatch and remove cover if desired.

2. Set power switch to ON.

3. Set FUNCTION switch to TEL SET DIAL.

4. Meter must indicate within green sector. If it does not, replace 9-volt amplifier battery as instructed in paragraph 5.3.

3.4 DIALING THROUGH.

1. Connect telephone set to TEL SET connectors.

2. Connect line to + and - connectors.

3. Set FUNCTION switch to TEL SET DIAL.

4. Dial desired number.

5. When tone is received, select desired function outlined in the following paragraphs.

3.5 LEVEL MEASUREMENT.

1. Connect line to + and - connectors.

2. If it is necessary to connect through to a reference tone generator or call a test board, perform the steps in paragraph 3.4.

3. For a 900Ω termination, set FUNCTION switch to one of the two DBM 900Ω TERM positions that results in an upper scale indication if possible.

4. For a bridging mode, set FUNCTION switch to one of the three DBM BRDG positions that results in an upper scale indication if possible.

3.6 LINE CURRENT MEASUREMENT.

1. Perform steps in paragraph 3.4.

2. Set FUNCTION switch to TEL SET 150MA.

3. Read line current on red DC 0 to 150 scale.

3.7 AC VOLTAGE MEASUREMENT.

1. Connect circuit under test to + and - connectors. Observe correct polarities.

2. Set FUNCTION switch to one of the two VAC positions.

3. Read voltage on black AC 0 to 150 scale.

3.8 DC VOLTAGE MEASUREMENT.

1. Connect circuit under test to + and - connectors. Observe correct polarities.

2. Set FUNCTION switch to one of the three VDC positions.

3. Read voltage on appropriate red DC scale.

3.9 DC CURRENT MEASUREMENT.

1. Connect circuit under test to + and - connectors. Observe correct polarities.

2. Set FUNCTION switch to one of the two MA DC scales.

3. Read current on appropriate red DC scale.

3.10 RESISTANCE MEASUREMENT.

1. Set FUNCTION switch to one of the two OHMS ranges.

2. Short test leads together.

3. Adjust OHMS ADJ. potentiometer to obtain a zero indication on meter. If meter cannot be zeroed, replace the two 1.5-volt batteries as instructed in paragraph 5.3.

4. Connect circuit under test to + and - connectors.

5. Read resistance on green scale.

SECTION 4

CIRCUIT DESCRIPTION

4.1 INTRODUCTION.

4.2 The following paragraphs provide the circuit description for the TTS 28. See figure 7-1 for the schematic diagram.

4.3 LEVEL MEASURING CIRCUIT.

4.4 In the terminated and bridged level measuring modes a high-impedance, high-pass filter is inserted between the input connectors and the amplifier. In the bridging mode the filter is connected directly to the input connectors. In the terminating mode the filter input is shunted by a resistance to provide an input impedance of 900Ω at 1000 Hz. Since this resistance is connected directly across the input connectors, it also provides a dc holding circuit. The filter is followed by a voltage divider type attenuator that feeds the amplifier. This circuit is a conventional two-stage, common-emitter amplifier that has the rectifier and meter located in the feedback path. This configuration and the use of specially selected components greatly stabilizes the amplifier gain against temperature and battery voltage variations. The amplifier-rectifier combination is designed to deliver approximately 0.5 milliamperes in the meter circuit. A 50 microampere meter movement is required to provide the 20,000Ω per volt dc sensitivity and therefore the meter is shunted in the level measuring modes. The amplifier has sufficient gain to provide a 0 dBm meter indication with an input signal of -5 dBm.

4.5 AC MEASURING CIRCUIT.

4.6 In the ac measuring mode the amplifier is connected to the input connectors through a voltage divider thereby bypassing the filter. In all other respects the function is identical to the level measuring mode.

4.7 MULTIMETER FUNCTIONS.

4.8 The dc multimeter circuits are conventional in design.

4.9 THROUGH CONNECTIONS.

4.10 In the TEL SET DIAL position, the meter is disconnected from the circuit so that it will not be affected by dial pulses and other transients. If the power switch is set to ON while in this position the meter will indicate the condition of the amplifier battery. When set to the TEL SET 150MA position, the meter is connected between the input + and - connectors and the TEL SET terminals to measure the current through the equipment connected to the TEL SET connectors.

SECTION 5

MAINTENANCE

5.1 INTRODUCTION.

5.2 Maintenance for the TTS 28 consists of battery replacement, mechanical meter zero, and level calibration procedures.

5.3 BATTERY REPLACEMENT.

5.4 To replace either the 9 volt amplifier battery or the two 1.5 volt ohms function batteries, perform the following steps.

1. Remove the two screws at the top and the two screws at the bottom of the front panel.

2. Remove front panel from case.

3. Remove defective battery or batteries from clip.

4. Replace with identical or equivalent batteries. See parts list in Section 6.

5. Check condition of replacement batteries as instructed in Section 3 before replacing front panel and securing screws.

5.5 METER MECHANICAL ZERO.

5.6 When the instrument is placed in the vertical orientation, and with no input signal, the meter needle must be positioned directly over the zero mark on the scales. If it is not, perform the following steps.

1. Place instrument in vertical position.

2. Remove all input signals.

3. Carefully position meter zero adjust screw until needle is positioned directly over zero mark on scales.

5.7 LEVEL CALIBRATION.

5.8 To calibrate the dBm level measuring function, perform the following steps.

1. If required, perform mechanical meter zero adjustment as outlined in paragraph 5.5.

2. Connect an accurate 900Ω, 1000 Hz, 1 milliwatt sine wave signal generator to the + and - input connectors.

3. Set FUNCTION switch to 0 DBM 900Ω TERM.

4. Set power switch to ON.

5. Set instrument in vertical position.

6. The meter must indicate exactly 0 dB.

7. If the meter indication is not correct, remove the four screws that secure front panel and remove instrument from case.

NOTE

Ensure that the instrument is in vertical position before making following adjustment.

8. On component circuit board, (figure 6-1) adjust R23 to obtain a meter indication of exactly 0 dB.

SECTION 6

ELECTRONIC PARTS LIST

6.1 INTRODUCTION.

6.2 Table 6-1 list all of the manufacturers found in the parts list, tables 6-2, 6-3, and 6-4.

Table 6-1. List of Manufacturers

P/L Name	Manufacturer
AB	Allen&Bradley, Milwaukee, Wis. 53204
Aerovox	Aerovox Corp., New Bedford, Mass. 02745
AH&H	Arrow-Hart and Hegeman, Hartford, Conn. 06106
Clarostat	Clarostat Mfg., Dover, N.H. 03820
Electra	Electra/Midlands, Mineral Wells, Texas 76067
Esse	Esse Co., Chicago, Ill. 60629
IRC	IRC Div. TRW Inc., Lynn, Mass. 01905
Sprague	Sprague Electric Co., Concord, N.H. 03301
Tel Lab	Tellabs Inc., Manchester, N.H. 03102
TI	Texas Instruments Inc., Dallas, Texas 75231
Trans	Transitron Electronics Corp., Boston, Mass. 02128
Weston	Weston Instruments Inc., Lexington, Mass. 02173

Table 6-2. TTS 28 Overall Parts List

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLT	MFGR.	MFGR. PART NO.	N.E.C. #
L1			00		UTC	HVC-8	455100600
M1		.05MA	2%		WESTON	1931	901200100
R1	5K	2 W	10%		CLAROSTAT	CM28463NP	230805022
S1	SPST	2 A	00	125V	AH+H	20994-LH	620100700

Table 6-3. Switch Subassembly S2 Parts List

REFERENCE DESIGNATOR	DESCRIPTION VALUE	POWER	TOL	VOLT	MFGR.	MFGR. PART NO.	N.E.C. #
R2	935#	3W	1%		TEL LAB	EL2E	210393501
R3	1MOK	1/2W	5%		AB	TYPE EB	200201845
R4	3.235K	1/8W	1%		ELECTRA	MF5C	220282311
R5	15.75K	1/8W	1%		ELECTRA	MF5C	220215721
R6	5.01K	1/8W	1%		ELECTRA	MF5C	220250111
R7	2.246K	1/8W	1%		ELECTRA	MF5C	220222411
R8	291.76K	1/8W	1%		ELECTRA	MF5C	220229131
R9	2.9918M	1W	1%		IRC	DCF	200629941
R10	10-	2W	1%		TEL LAB	EL-2H	210210091
R11	3M	1W	1%		IRC	DCG	200603057
R12	597.6K	1/8W	.5%		ELECTRA	MF5C	220359727
R13	27.6K	1/8W	.5%		ELECTRA	MF5C	220327627
R14	SAME AS R13						
R15	3.6K	1/8W	1%		ELECTRA	MF5C	220236011
R16	101-	1/8W	1%		ELECTRA	MF5C	220210101
R17	16.19K	1/8W	1%		ELECTRA	MF5C	220216121
R18	15.8-	1/8W	1%		ELECTRA	MF5C	220215891
R19	2.16K	1/8W	1%		ELECTRA	MF5C	220221611

Table 6-4. Component Board Parts List

REFERENCE DESIGNATOR	VALUE	DESCRIPTION POWER	TOL	VOLT	MFGR.	MFGR. PART NO.	W.E.C. #
C1	.047MF		10%	200V	SPRAGUE	2TM-S47	320504730
C2	SAME AS C1						
C3	.5MF		20%	200V	AEROVOX	PB292ZN-12	320705040
C4	20MF		00	15V	SPRAGUE	TE1157	300202060
C5	SAME AS C4						
C6	SAME AS C4						
D1	A21	80MW	00	80V	TRANS.	1N198	561001980
D2	SAME AS D1						
D3	SAME AS D1						
D4	SAME AS D1						
Q1	TU36MS	200MW	00	20V	TI	TI494	550004940
Q2	SAME AS Q1						
R20	22UK	1/2W	5%		AB	TYPE EB	200202245
R21	15K	1/2W	5%		AB	TYPE EB	200201535
R22	560-	1/8W	1%		ELECTRA	MF5C	220256001
R23	200W	3 W	20%		ESSE	11105	230502010
R24	68K	1/2W	5%		AB	TYPE EB	200206835
R25	1.8K	1/2W	5%		AB	TYPE EB	200201825
R26	6.8K	1/8W	1%		ELECTRA	MF5C	220268011
R27	1300-	1/8W	1%		ELECTRA	MF5C	220213011
R28	267-	1/8W	1%		ELECTRA	MF5C	220226701

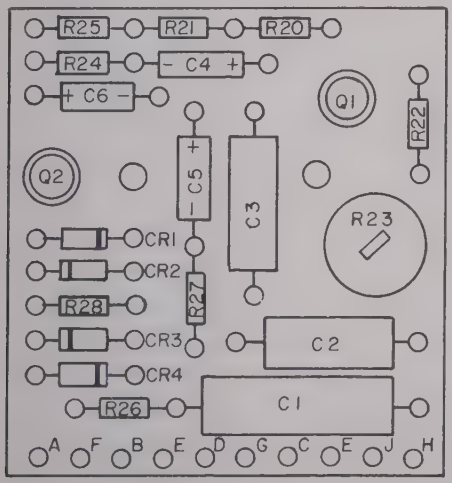

Figure 6-1. Printed Circuit Board, Component Location

SECTION 7

SCHEMATICS

7.1 INTRODUCTION

7.2 Figure 7-1 is the schematic diagram for the TTS 28 Portable Station Test Set.

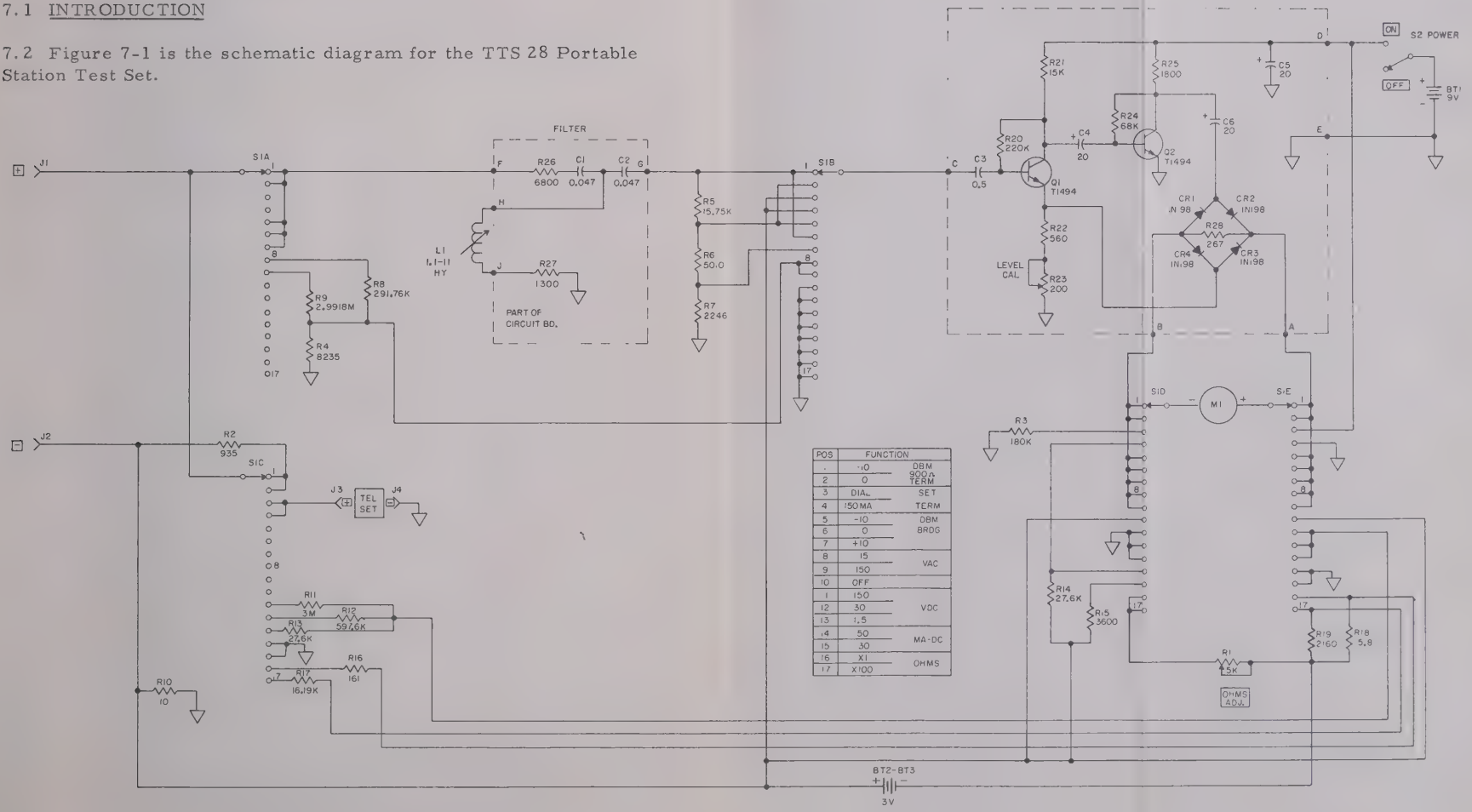

Figure 7-1. TTS 28 Portable Station Test Set, Schematic Diagram

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